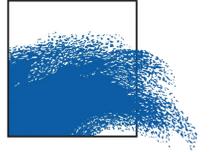


OFFSHORE WIND IN THE BELGIAN PART OF THE NORTH SEA: Understanding of environmental impacts

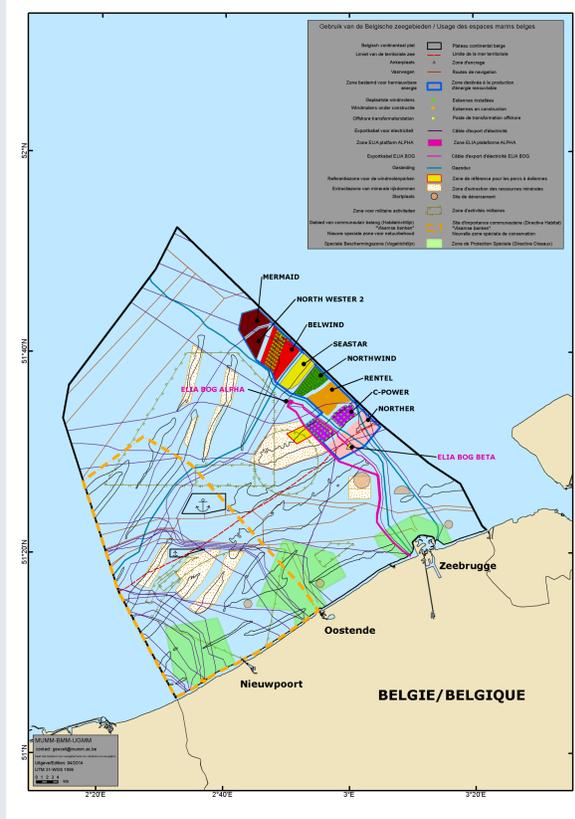


Offshore wind energy in Belgium

In 2004, the Belgian government assigned a zone for wind energy in the Belgian part of the North Sea.

Since then six projects were granted an environmental license to build and manage a wind farm. Two more projects are in development, one of which includes wave energy.

Three wind farms on the Thornton Bank (C-Power), Lodewijk Bank (Northwind) and the Bligh Bank (Belwind) are currently active. The Belgian government aims to achieve 2 Gigawatt of installed capacity by 2020.

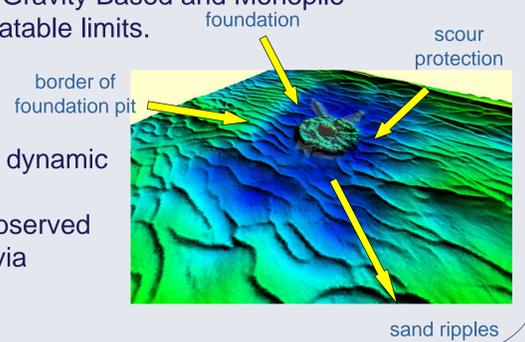


Results

Some selected results are briefly mentioned here. Please consult the yearly and summary report for more information.

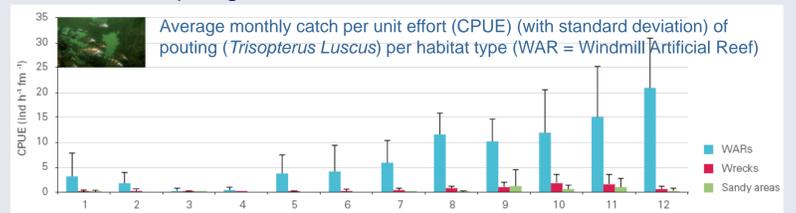
Geophysical environment:

- Sediment erosion around both Gravity Based and Monopile foundations stays within acceptable limits.
- No secondary scour observed
- Sand ripples recovered quickly
- Electricity export cables were susceptible to exposure due to dynamic sand dune migration
- Suspended sediment wakes observed behind offshore wind turbines via satellite imagery



Biological environment:

- Rapid colonisation after installation of available hard substrates (in a previously soft substrate environment)
- Attraction of fish species (i.e. pouting) feeding on the fouling species
- Dominance of invasive and warm water species in the intertidal zone → **stepping stone effect**
- Avoidance of the wind farms by certain bird species (i.e. northern gannet and common guillemot) and attraction by others (i.e. herring gull)
- Excessive underwater noise levels during piling (i.e. 179 dB re 1 µPa @ 750m), were related to disturbance of and avoidance by porpoises up to 20 km from the piling location



Socio-economic environment:

- Social acceptance of offshore wind in coastal communities increased after construction of the first wind farms
- Fisheries activities initially increased in the area surrounding the first wind farms, but decreased after a few years
- Concern about the environmental impact of offshore wind was one of the major factors limiting social acceptance

Approach to environmental monitoring

The environmental licenses include a monitoring program to allow for a proper evaluation of both the environmental impacts of offshore wind farms and the use of mitigation measures. This **integrated, long-term (2005-2022) program targets physical** (i.e. hydro-geomorphology and under-water noise), **biological** (i.e. hard substratum epifauna, hard substratum fish, soft substratum macrobenthos, soft substratum epibenthos and fish, seabirds and marine mammals), as well as **socio-economical** (i.e. seascape perception and offshore renewables appreciation) aspects of the marine environment.

The monitoring strategy consists of a baseline and a targeted monitoring:

Baseline monitoring focuses on the a posteriori, resultant impact quantification and deals with observing rather than understanding impacts.

Targeted monitoring upgrades the monitoring to a level of process understanding and focuses on cause-effect relationships of a priori selected impacts. Linking environmental changes to an underlying cause-effect rationale, will allow for an **effective regulatory management**

Monitoring data, yearly reports and summary report available via www.mumm.ac.be or upon request!

Conclusions

Six years of monitoring triggered a reflection on how to best continue the monitoring:

Basic Monitoring

- Rationalize basic monitoring at the level of the likelihood of impact detection (in relation to research effort and impact size)
- Relate monitoring effort to the current implementation of European Directives
- Consider representativeness of current findings

Targeted Monitoring

- Attraction-production hypothesis at the level of artificial reefs
- Presence of bats and the impact of offshore wind farms

Major Challenges

- **Upscaling locally observed impacts to a larger scale**
- **Reliably assess cumulative impacts**